What is claimed is:

1. A method of transmitting a data bit stream on a transmission system, the transmission system having a plurality of carriers and a target bit error rate, each carrier initially having a known transmit power, comprising the steps of:

a. estimating a signal to noise ratio for each carrier for the transmit power for each carrier;

b. allocating a quantity of bits for each carrier so that the bit error rate is less than or equal to the target bit error rate with the estimated signal to noise ratio, wherein the quantity of bits is a whole number greater than or equal to zero;

c. computing total excess power available for a current allocation of bits;

d. computing gains required by each carrier to carry additional bits;

e. allocating at least a portion of the total excess power to at least one carrier on the basis of the computed gains required by each carrier to carry additional bits;

f. converting the data bit stream into a plurality of parallel bit streams based on the allocation of the total excess power;

g. encoding the parallel bit streams;

h. scaling the encoded parallel bit streams with a gain based on the allocation of the total excess power; and

i. modulating the encoded and scaled parallel bit streams for transmission.

2. The method of claim 1, wherein the step of allocating total excess power further comprises sorting the plurality of carriers from least to greatest computed gain to carry additional bits and allocating the total excess power based on the sorted order of the plurality of carriers.

3. The method of claim 1, further comprising repeating the steps of computing total excess power available for a current allocation of bits; computing gains and excess power required by each carrier to carry additional bits; and allocating at least a portion of the total excess power to at least one carrier on the basis of the computed gains required by each carrier to carry additional bits.

4. The method of claim 3, wherein the repeating of the steps is terminated when a target bit rate is achieved.

5. The method of claim 3, wherein the repeating of the steps is terminated upon the expiration of an allocated processing time.

6. The method of claim 1, wherein the step of computing total excess power further comprises the steps of:

a. computing a signal to noise ratio required for achieving the target bit error rate for the currently allocated quantity of bits for all carriers having a non zero bit allocation;

b. calculating a reduced transmit power for each carrier having a non zero bit allocation required to achieve the computed signal to noise ratio;

c. calculating an excess power for each carrier where a reduced transmit power is calculated, the excess power being based on the difference between the transmit power and the calculated reduced transmit power for the carrier; and

d. summing the excess power for all carriers carrying data bits.

7. The method of claim 6, wherein the step of calculating a reduced transmit power is subject to a minimum power constraint for each carrier.

8. The method of claim 6, wherein the step of calculating a reduced transmit power in a carrier is calculated based on a ratio of the calculated signal to noise ratio to the estimated signal to noise ratio.

9. The method of claim 1, further comprising the step of reallocating one or more bits from a first carrier having a quantity of bits greater than zero to a second carrier having an initial allocation of zero bits.

10. The method of claim 1, wherein the step of computing gains required by each carrier to carry additional bits further comprises computing excess power required by each carrier to carry additional bits.

11. The method of claim 1, further comprising allocating fractional bits to a set of carriers out of the plurality of carriers having the smallest cardinality.

12. The method of claim 11 wherein the step of allocating fractional bits to a set of carriers out of the plurality of carriers having the smallest cardinality further comprises allocating fractional bits to a set of carriers having a lesser power requirement.

13. The method of claim 1, wherein the step of scaling the encoded parallel bit streams further comprises scaling with complex gains.

14. The method of claim 1, wherein the encoded parallel bit streams comprise QAM symbols, and wherein the step of scaling the QAM symbols comprises scaling with gains that are unequal in the X and Y axes.

15. A method of transmitting a data bit stream on a transmission system, the transmission system having a plurality of carriers and a target bit error rate, each carrier initially having a known transmit power, comprising the steps of:

a. estimating a signal to noise ratio for each carrier for the transmit power for each carrier;

b. allocating a quantity of bits for each carrier so that the bit error rate is less than or equal to the target bit error rate with the estimated signal to noise ratio, wherein the quantity of bits is a whole number greater than or equal to zero;

c. computing total excess power available for a current allocation of bits;

d. computing excess power required by each carrier to carry additional bits;

e. allocating at least a portion of the total excess power to at least one carrier on the basis of the computed excess power required by each carrier to carry additional bits;

f. converting the data bit stream into a plurality of parallel bit streams based on the allocation of the total excess power;

g. encoding the parallel bit streams;

h. scaling the encoded parallel bit streams with a gain based on the allocation of the total excess power; and

i. modulating the encoded and scaled parallel bit streams for transmission.

16. The method of claim 15 wherein the step of allocating the total excess power further comprises sorting the plurality of carriers from least to greatest computed excess power to carry additional bits and allocating the total excess power based on the sorted order of the plurality of carriers.

17. The method of claim 15, further comprising repeating the steps of computing total excess power available for a current allocation of bits; computing excess power required by each carrier to carry additional bits; and allocating at least a

portion of the total excess power to at least one carrier on the basis of the computed excess power required by each carrier to carry additional bits.

18. The method of claim 17, wherein the repeating of the steps is terminated when a target bit rate is achieved.

19. The method of claim 17, wherein the repeating of the steps is terminated upon the expiration of an allocated processing time.

20. The method of claim 15, wherein the step of computing total excess power further comprises the steps of:

a. computing a signal to noise ratio required for achieving the target bit error rate for the currently allocated quantity of bits for all carriers having a non zero bit allocation;

b. calculating a reduced transmit power for each carrier having a non zero bit allocation required to achieve the computed signal to noise ratio;

c. calculating an excess power for each carrier where a reduced transmit power is calculated, the excess power being based on the difference between the transmit power and the calculated reduced transmit power for the carrier; and

d. summing the excess power for each carrier in all carriers carrying data bits.

21. The method of claim 20, wherein the step of calculating a reduced transmit power is subject to a minimum power constraint for each carrier.

22. The method of claim 20, wherein the step of calculating a reduced transmit power in a carrier is calculated based on a ratio of the calculated signal to noise ratio to the estimated signal to noise ratio.

23. The method of claim 20, further comprising the step of reallocating one or more bits from a first carrier having a quantity of bits to a second carrier having an initial allocation of zero bits.

24. The method of claim 15, wherein the step of computing gains required by each carrier to carry additional bits further comprises computing excess power required by each carrier to carry additional bits.

25. The method of claim 15, further comprising allocating fractional bits to a set of carriers out of the plurality of carriers having the smallest cardinality.

26. The method of claim 25, wherein the step of allocating fractional bits to a set of carriers out of the plurality of carriers having the smallest cardinality further comprises allocating fractional bits to a set of carriers having a lesser power requirement.

27. The method of claim 15, wherein the step of scaling the encoded parallel bit steams further comprises scaling with complex gains.

28. The method of claim 15, wherein the encoded parallel bit streams comprise QAM symbols and wherein the step of scaling QAM symbols comprises scaling with gains that are unequal in the X and Y axes.

29. A transmission system having a plurality of carriers and a target bit error rate, each carrier initially having a nominal or known transmit power, comprising:

a. means for converting a serial data stream into a plurality of parallel data streams, each parallel data stream having a bit rate;

b. means for encoding the parallel data streams in a quadrature amplitude modulation points connected to the means for converting;

c. means for scaling the encoded parallel data streams connected to the means for encoding;

d. means for modulating the scaled encoder connected to the means for scaling;

e. means for allocating the bit rate for each of the parallel data streams and for allocating power for the means for scaling, comprising:

1. means for estimating a signal to noise ratio for each carrier for the transmit power for each carrier;

2. means for allocating a quantity of bits for each carrier so that the bit error rate is less than or equal to the target bit error rate with the estimated signal to noise ratio, wherein the quantity of bits is a whole number greater than or equal to zero;

3. means for computing total excess power available for a current allocation of bits;

4. means for computing additional power required by each carrier to carry additional bits; and

5. means for allocating at least a portion of the total excess power to at least one carrier in response to the means for computing total excess power and the means for computing additional power required by each carrier to carry additional bits;

f a channel connected to the means for modulating;

g. means for demodulating, connected to the channel;

h. means for applying inverse scaling connected to the means for demodulating;

i. means for decoding quadrature amplitude modulation points connected to the means for inverse scaling; and

j. means for converting a plurality of parallel data streams into a serial data stream connected to the means for decoding quadrature amplitude modulation points.

30. The transmission system of claim 29, wherein the means for computing additional power required by each carrier to carry additional bits further comprises means for computing gains required by each carrier to carry additional bits.

31. The transmission system of claim 30, wherein the means for allocating the total excess power further comprises allocating a portion of excess power to a first carrier having a smallest computed gain to carry additional bits and a portion of the total excess power is allocated to a second carrier having a second smallest computed gain to carry additional bits.

32. The transmission system of claim 29, wherein the means for computing additional power required by each carrier to carry additional bits further comprises means for computing excess power required by each carrier to carry additional bits.

33. The transmission system of claim 32, wherein the means for allocating the total excess power further comprises allocating a portion of excess power to a first carrier having a smallest computed excess power to carry additional bits and a portion of the total excess power is allocated to a second carrier having a second smallest computed excess power to carry additional bits.

34. The transmission system of claim 29, wherein the means for computing total excess power further comprises:

a. means for computing a signal to noise ratio required for achieving the target bit error rate for the currently allocated quantity of bits for all carriers having a non zero bit allocation;

b. means for calculating a reduced transmit power for each carrier having a non zero bit allocation required to achieve the computed signal to noise ratio;

c. means for calculating an excess power for each carrier where a reduced transmit power is calculated; and

d. means for summing the excess power for each carrier in all carriers carrying data bits.

35. The transmission system of claim 29, further comprising means for reallocating one or more bits from a first carrier having a quantity of bits to a second carrier having an initial allocation of zero bits.

36 The transmission system of claim 29, further comprising means for allocating fractional bits to a set of carriers out of the plurality of carriers having the smallest cardinality.

37. The transmission system of claim 36, wherein the means for allocating fractional bits to a set of carriers out of the plurality of carriers having the smallest cardinality further comprises means for allocating fractional bits to a set of carriers having a lesser power requirement.

38. The transmission system of claim 29, wherein the means for scaling comprises means for scaling with a complex gain.

39. The transmission system of claim 29, wherein the means for scaling comprises means for scaling with an x-axis gain and with a y-axis gain, wherein the x-axis gain is not equal to the y-axis gain.

40. The transmission system of claim 29, wherein the means for allocating the bit rate for each of the parallel data streams and for allocating power repeats until a target bit rate is achieved.

41. The transmission system of claim 29, wherein the means for allocating the bit rate for each of the parallel data streams and for allocating power repeats until a predetermined allocation of time expires.

42. A method of conveying fractional bit allocation from a receiver to a transmitter coupled by a plurality of carriers, comprising:

a. allocating fractional bits across a set of carriers of the plurality of carriers;

b. identifying all carriers in the set of carriers with a predetermined bit pattern; and

c. applying a pseudo-random phase offset to the carriers identified with the predetermined bit pattern.

43. The method of claim 42, wherein the step of applying a pseudo-random phase offset to the carriers identified with the predetermined bit pattern further comprises applying a pseudo-random phase offset in multiples of 45 degrees.